

40. (Currently Amended) The method according to claim 39, wherein the at least one mark region is an elongated ~~[[mask]]~~mark region extending parallel to a supporting strut of the mask.
41. (Previously Presented) The method according to claim 39, wherein the scanning of the beam of charged particles is controlled such that a deviation between a line along which the cross-section of the beam of charged particles is scanned in the plane of the mask and a predetermined line is minimised.
42. (Previously Presented) The method according to claim 39, wherein the controlling of the scanning of the beam of charged particles comprises stopping the scanning along a predetermined line based on the detected radiation.

REMARKS

Please reconsider the application in view of the above amendments and the following remarks. Applicant thanks the Examiner for carefully considering this application as well as for the courtesies extended during the interview on July 29, 2004.

Disposition of Claims

Claims 1, 3-9, 27-30, and 38-42 are pending in this application. Claims 1, 4, 28 and 39 are independent. Claims 4 and 28 have been written in independent form by including the limitations of their base claim 1. Claims 1, 39 and 40 have been amended.

Objections

Pursuant to the Examiner's request, the Response filed August 11, 2004, enclosed copies of the following documents: the European Search Report dated December 29,

2003; the document titled "Marks for Alignment and Registration in Projection Electron Lithography in Projection Electron Lithography", Jour. of Vacuum Science & Technology B; Vol. 11, No. 6, Nov/Dec 1993, pages 2175-2178; and U.S. Patents No. 5,648,188 and 6,204,509. Please note that these documents were included in the Information Disclosure Statement filed on January 13, 2004.

Applicants respectfully request return of the initialed PTO Form-1449 from the multiple Information Disclosure Statements filed on July 25, 2002, December 11, 2001, March 25, 2003, and January 13, 2004.

Rejection(s) under 35 U.S.C § 112

Claim 40 stands rejected under 35 U.S.C. 112, second paragraph, as being indefinite due to a typographical error. This error has been corrected above. Accordingly, withdrawal of the rejection is requested.

Rejection(s) under 35 U.S.C § 102

Claims 1, 3, 7-9, 27 and 38-42 stand rejected under 35 U.S.C. § 102 as anticipated by U.S. Patent No. 6,204,509 ("Yahiro *et al.*"). To the extent that this rejection may apply to the amended claims, the rejection is respectfully traversed.

The present invention relates to avoiding deviations of a beam of charged particles from a predetermined path while imaging the pattern of a mask onto a substrate using the beam of charged particles.

Claim 1 as amended defines a deflector for moving the beam cross section of a

beam of charged particles along a predetermined path extending over a mask. A sensor detects, concurrently with the imaging operation, a number of the charged particles that impinge on mark region(s) provided on the mask. Further, the deflector is responsive to a measuring signal dependent on the number of charged particles detected by the sensor in order to reduce deviations from the path extending over the mask parallel to the direction of the struts.

Yahiro *et al.* does not disclose detecting the mask's distortion concurrently with the imaging of the mask via the beam of charged particles used for imaging the mask. According to all of the Yahiro *et al.* embodiments using beams of charged particles to detect distortion, the determination of the mask distortion is made prior to the imaging of the mask's pattern. For example, in the fifth embodiment, Yahiro *et al.* states that "[t]he actual respective positions of the alignment marks 53 for all the individual subfields 50 can be determined prior to exposing any of the subfields 50 of the reticle 5. The necessary manipulation of the electron beam is then calculated in advance for each reticle subfield." (Column 12, lines 60-64, emphasis added.) Regarding the embodiments shown in Figures 10 and 11 of Yahiro *et al.*, in which an electron beam is used for detecting the positions of the alignment marks, a reflected electron detector 25c is disposed upstream of the electron beam EB with respect to the mask and detects electrons of the electron beam which are incident on one of the alignment marks 57d. To detect the position of the alignment mark, the electron beam EB is scanned over the alignment mark 57d in two dimensions (x and y directions). (See column 15, lines 10 to 13.) However, scanning only one single alignment mark is not sufficient for determining the distortion of the mask. For this purpose, the positions of multiple alignment marks

must be determined by independently scanning each alignment mark in two dimensions. Then, calculations are performed to determine the absolute positions of the marks in coordinate space, from which information for the subsequent exposure of the pattern onto the substrate can be corrected for any distortion. This, of course, requires the correction parameters to be determined prior to exposure of the substrate.

Amended Claim 39 describes a method for exposing a radiation-sensitive layer. The method comprises generating a shaped beam of charged particles in a plane of a mask providing a pattern to be imaged onto a radiation-sensitive layer; scanning the beam of charged particles along a predetermined path; detecting radiation generated by a number of the charged particles incident on at least one mark region provided on the mask, wherein the detecting of the radiation is performed concurrently with the exposing of the radiation-sensitive layer; and controlling the scanning of the beam of charged particles based on the detected radiation.

Yahiro *et al.* does not disclose detecting radiation generated by a number of the charged particles incident on at least one mark region concurrently with exposing of the radiation sensitive layer. As explained above, Yahiro *et al.* discloses detecting the radiation generated by charged particles incident on at least one mark region prior to exposing the radiation sensitive layer.

In view of the above, Yahiro *et al.* fails to show or suggest the invention as recited in claims 1 and 39. Thus, claims 1 and 39 are patentable over the cited prior art. Claims 3, 7-9, 27, 38, and 40-42 are dependent, directly or indirectly, from patentable base claims and therefore should be patentable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

Claims 4 and 28 have been written in independent form by including the limitations of their base claim 1. Thus, claims 4 and 28 are allowable as indicated by the Examiner in the Office Action dated December 16, 2003. Claims 5 and 6 are dependent from patentable claim 4 and therefore should be patentable for at least the same reasons.

Response to Advisory Action

The Advisory Action mailed August 25, 2004, refused entry of the above amendments on the grounds of new matter. Applicant strongly disagrees, and believes this is a symptom of the same apparent misunderstanding of the claimed invention that was discussed during the interview. Claim 1, for example, prior to the amendments above, required, *inter alia*:

1. “imaging a pattern of a mask onto a substrate using a beam of charged particles”;
2. “a deflector for scanning ... the beam of charged particles ... along a predetermined path over the mask”;
3. “a sensor for detecting, concurrently with the scanning of the beam of charged particles along the predetermined path...”

Because the existing wording of claim 1 required that the imaging of the pattern of the mask is done by scanning a beam of charged particles along a predetermined path, and further that the detecting of the mark-impinging particles occurs concurrently with the scanning, *a fortiori* the detecting must be concurrent with the imaging. This concept was at the heart of the interview, during which the Examiner recognized this “concurrent” nature of the invention does not exist in the prior art. The Examiner suggested that this

"concurrent" nature of the invention be more clearly described, and Applicant agreed to do so, even though Applicant believes this limitation was already clearly present in the claim. Thus, Applicant is now at a loss to understand the basis of the "new matter" objection. Support for the amendments is clearly present in the claims themselves. Support is also found in Figures 3, 4, 5, 6, 10, 11, 12, and 13, each of which illustrates an embodiment of concurrent imaging and mark-impingement detection.

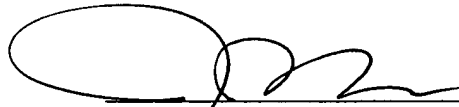
In view of the above, entry of the amendments is respectfully requested.

Applicant believes this reply is fully responsive to all outstanding issues and places this application in condition for allowance. If this belief is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned or his associates at the telephone number listed below. Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference Number 03850/010001).

Respectfully submitted,

Date: _____

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